the screw (S) left open to permit of the escape of the gas. As soon as the whole mass of liquid has been reduced to a temperature of − 23° the ebullition ceases, the screw (S) may be replaced, and if a temperature lower than − 23° be required the tube (B) placed in connection with a good air-pump. By this simple means a litre of alcohol can be kept for several hours at temperatures either of − 23° or − 55°, and thus a large number of experiments can be performed for which hitherto the expensive liquid nitrous oxide or solid carbonic acid was required.

M. Camille Vincent has recently constructed a much larger and more perfect and continuous form of freezing-machine, in which, by means of an air-pump and a forcing-pump, the chloride of methyl is evaporated in the freezing-machine, and again condensed in the cylinders. This enlarged form of apparatus will probably compete favourably with the ether- and sulphurous acid freezing-machines now in use, as they can be simply constructed, and as the vapour and liquid employed does not attack metal, is non-poisonous, and as the frigorific effects which it is capable of producing are most energetic.

The second and perhaps more important application of methyl-chloride is to the manufacture of methylated colours.

It is well known that rosaniline or aniline red, $C_{20}H_{19}N_3$, yields compounds possessing a fine blue violet or green colour, when a portion of the hydrogen has been replaced by the radicals, methyl or ethyl, and the larger the proportion of hydrogen replaced, the deeper is the shade of violet produced. Then we have triethyl rosaniline, or Hofmann's[1] violet, $C_{20}H_{16}(C_2H_5)_3N_3$.

By the replacing one or two atoms of the hydrogen of aniline by methyl, and by oxidising the methyl-aniline, Charles Lauth obtained fine violet colours, whilst about the same time Hofmann observed the production of a bright green colouring matter now known as iodine green, formed during the manufacture of the violet, and produced from this latter colour by the action of methyl-iodide.

In order to prepare aniline green from the pure chloride of methyl a solution of methyl-aniline violet in methyl-alcohol is placed in an iron digester, and the liquid rendered alkaline by caustic soda. Having closed the digester, a given quantity of liquid chloride of methyl is added by opening a tap, and the digester thus charged is placed in a water bath, heated by a jet of steam until the temperature reaches 95°, and the indicated pressure amounts to from 4 to 5 atmospheres. As soon as the reaction is complete the hot water is replaced by cold, and the internal pressure reduced by opening the screw-tap of the digester. The product of this reaction, heated and filtered, yields the soluble and colourless base, whose salts are green. To the acidified solution a zinc-salt is added to form a double salt, and the green compound is then precipitated by the addition of common salt. By adding ammonia to a solution of the methyl green salt, a colourless liquid is obtained in which cloth mordanted with tannic acid and tartar-emetic becomes dyed green (R. S. Dale).

If rosaniline be substited for methyl-aniline in the preceding reaction, Hofmann's violet is obtained. The application of methyl-chloride to the preparation of violets and greens is, however, it must be remembered, not due to M. Vincent; it has been practised for some years by various aniline colour makers. M. Vincent's merit is in establishing a cheap method by which perfectly pure chloride of methyl can be obtained, and thus rendering the processes of the manufacture of colours much more certain than it has hitherto been. By the use of this material the aniline can be methylated in simple cast-iron boilers heated by steam, and under a pressure much more moderate than is otherwise required.

In reviewing the new chemical industry of the beet-root vinasses one cannot help being struck by the knowledge and ability which have been so successfully expended by M. Camille Vincent, on the working out of the processes. Here again we have another instance of the utilisation of waste chemical products and of the preparation on a gigantic scale of compounds hitherto known only as chemical rarities. All those interested in the progress of scientific research must congratulate M. Camille Vincent on this most successful issue of his labours.

ILLUMINATION IN SPECTROSCOPY[2]

AFTER having shown how intrinsic brilliancy of the light operated on was the chief visual step to excellence in spectroscopic observations, the author proved that the temperature of the light must be kept constant, or we might be landed in a totally different class of physical phenomena of a most confounding character.

Coming, then, practically to *flame*-spectroscopy, he described the results hitherto obtained by all the leading spectroscopists respecting the peculiar lines and bands, all of them very faint, of the blue-grey blowpipe flame of coal-gas and common air; and then showed how, by merely looking at one and the same flame *end-on*, in place of transversely, according to the usual custom, all the features hitherto chronicled may be seen some five times brighter; while many other details not dreamt of before come into view, and the temperature remains undisturbed.

Next applying the same principle to the electric-spark illumination of gas-vacuum tubes, a still greater proportional improvement was obtained. But not until the author had invented or arranged a new description of such tubes, which rendered the application of the end-on principle possible. Examples of these new tubes, as prepared lately for the author by M. Salleron, 24, rue Pavée au Marais, Paris, were exhibited; and several proofs of their superior brightness of illumination were given. The last being that in a narrow and critical region of a rather faint and difficult carbonaceous spectrum, where the Royal Society, London, has published eight lines only, and those dark ones—the new tubes showed thirty-one lines, and all of them bright ones. As yet the author had only been able to get twelve different gases thus prepared; but with such decided improvement of spectroscopic vision in every case, that he hopes so increased a demand may soon flow in upon M. Salleron, as will make it worth his while to prepare similar end-on tubes of all known volatile products; and the result can hardly but prove most favourable to the progress of spectroscopic science.[1]

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

DR. J. H. BALFOUR, Professor of Botany in the Edinburgh University, has resigned his chair, which he has filled since 1845, on account of failing health. The patronage of the Chair of Botany is vested in the curators of the University. Among the candidates for the chair, we learn, are Mr. Carruthers, Prof. Dickson, of Glasgow, Mr. J. Bailey Balfour, and Prof. McNab, of Dublin.

THERE was much fine talk last Wednesday at the Mansion House on the subject of University extension in London, and it was pleasing to see a prince take an apparently genuine interest in the intellectual advancement of the people. We sincerely hope that the movement may lead to a substantial and durable result, though we very much doubt it. What we want most in London is a true university after the German model, not a "Cambridge extension." We are glad that Prince Leopold, in his really able address at the Birkbeck Institution on Tuesday, insisted so strongly on the weak point of the British workman, and that he can only hope to hold his own by the side of the foreign workman by starting with an equally good education.

AT the annual meeting of the trustees of the Birmingham Science College, under the presidency of the founder, Sir Josiah Mason, who celebrated on Monday his eighty-fourth birthday, it was announced that the college building, a handsome Gothic structure in the rear of the Birmingham Town Hall, is rapidly approaching completion, and the formal opening will probably be made on the founder's next birthday. Nearly 150,000*l*. has been expended on the college building and endowment.

SCIENTIFIC SERIALS

American Journal of Science and Arts, February.—We have here two interesting papers on acoustics. Mr. Jacques has inquired into the velocity of loud sounds, measuring the velocity at different short distances from a cannon by means of a series of membranes electrically connected with a chronograph. He finds that the velocity of sound is a function of its intensity, and that experiments in which a cannon is used contain an error, probably due to the bodily motion of the air near the cannon. Immediately in the rear of the cannon the velocity was less than at a distance, but, going from the cannon, the velocity rose to a maximum considerably above the ordinary velocity, and then fell gradually to the rate usually received. When the cannon was pointed

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[1] Hofmann, *Proc.* Roy. Soc., xiii. 13 (1863).

[2] Abstract of paper upon "End-on, in Place of Transverse, Illumination in Private Spectroscopy," by Mr. Piazzi Smyth, Past President of R. Sc. Soc. Arts. Edinb., February 10, 1879.

[1] Tubes similar to those referred to are already well-known in England; Dr. Monckhoven has in fact pointed out the value of such tubes, and sent specimens to several observers in England.—ED.

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at right angles to its first position, the maximum velocity came nearer it, and had the cannon been pointed towards the membranes, the retardation would probably have become an acceleration.—Dr. Ihlseng has measured the velocity of sound in wood, both by Kundt's method and the graphic method, in which latter a blackened glass plate was drawn rapidly in a horizontal direction (across the direction of the rod's length), by a falling weight, and a pen attached to the rod wrote its vibration on the plate, which also registered those of a tuning-fork. This method was found one of considerable accuracy. Its results were slightly below those by Kundt's method, and (when the plate was moved in a different direction) it demonstrated the existence of transverse along with longitudinal, and gave their ratios.—Mr. Pumpelly writes on the relation of secular rock disintegration to lœss, glacial drift, and rock basins; Mr. Fontaine continues his notes on the mesozoic strata of Virginia; and Mr. Hawes describes a group of dissimilar eruptive rocks in Compton, New Hampshire.—In a method of determining dip, devised by Mr. Hodges, a compound bar is used consisting of two joined at right angles at a point near their ends; when placed so that the two branches make equal angles with the line of dip, the two joined poles neutralise each other, and any needle suspended near that point is unaffected. A slight turning of the compound bar renders the field round the needle a north or a south, and the needle moves correspondingly.—Some notices of recent American earthquakes are furnished by Prof. Rockwood, Jun.

Journal de Physique, January.—This number opens with M. Joubert's researches on the rotatory power of quartz and its variations with the temperature; they prove that quartz constitutes a thermometer of extreme sensibility.—A new and simple regulator of velocity, for electric motors especially, described by M. Deprez, rests on the principle of centrifugal force acting on one end (loaded) of a flexible metallic strip, and (with a certain intensity) breaking contact of an adjusting screw at that end with a metallic piece, and so stopping a current which actuates the motor.—M. Witz studies the thermal effects of the walls of an inclosure on the gases it contains.—M. Pellat describes an apparatus for effecting the synthesis of compound colours, the very colours of the spectrum being taken in the desired proportions and mixed completely; and M. Schwedoff one for studying the vibratory movements of cords, the cord being [set in motion by means of an electric trembler at one end.

THE *Sitzungsberichte der naturwissenschaftlichen Gesellschaft Isis in Dresden* (1878, part 1, January to July) contain the following papers of interest:—On Heligoland and Norderney from a geological point of view, by C. D. Carstens.—On the tertiary flora of the Klein Purberg near Czernowitz, by Herr Engelhardt.—On amber, by Dr. O. Schneider.—On the saltpetre and the guano from the Atakama Desert, by Herr Weis.—On fossil man, by Herr Engelhardt.—On some prehistoric remains discovered on the Hradischt in Bohemia, by W. Osborne.—On palm leaves, by Herr von Biedermann.—On the largest elm tree of Germany, by C. F. Seidel. The tree in question stands in the village of Schimsheim near the railway station of Armsheim in Rhenish Hessen, and measures 30 metres in height, its trunk 15·07 metres in circumference, while its age is estimated at close upon 600 years.—On the colour which a gas flame assumes in the vapour generated by a mixture of permanganate of potash and sulphuric acid, by Carl Bley.—On the formation of crude coralline and of resorcine-oxalëine, by Dr. Schmitt.—On the action of ethyl mercaptan on diazo-compounds, by the same.—On a curious occurrence of tape-worms, by Herr Ebert.—On a Chinese work on insects, by C. F. Seidel.—On the origin of organic life upon the earth, by Dr. Steil.—On the red gneiss near Freiberg in Saxony, by Dr. Geinitz.—On the natural history of the Caucasus countries, by Dr. Oscar Schneider.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 30.—"On the determination of the Rate of Vibration of Tuning Forks," by Herbert McLeod, F.C.S., and George Sydenham Clarke, Lieut. R.E. Communicated by Lord Rayleigh, F.R.S.

The paper contains a description of some experiments made with a view to determine the absolute pitch of tuning forks by means of a method proposed by the writers in a previous paper (*Proc.* Roy. Soc., 1877, xxvi. 162).

It commences with a description of the time-measurer adopted, consisting of a compensated pendulum, worked by electricity, the impulse being given by a driver depending for its action on gravity alone. The pendulum is arranged to give second contacts, driving a clock-wheel with sixty teeth. This wheel has a platinum pin giving minute contacts, but it is used merely as a switch, the circuit being closed by the pendulum itself. The current works a relay, and closes the circuit required.

The tuning-fork apparatus consists of a brass drum resting on friction-wheels, and driven by a weight and train. Uniformity of motion being of great importance, an air-regulator, consisting of a fan inclosed in the lower compartment of a cylindrical box, is employed. By means of a diaphragm and vanes the fan can be made to do more or less work by pumping air from the lower into the upper compartment. The fan spindle carries a pulley driven by a thread passing round the drum.

Round one end of the drum are wrapped strips of paper on which white equidistant lines have been so ruled that they are parallel to the axis of the drum when the strips are in position. The strip most frequently used has 486 lines round the complete circumference of the drum. Opposite this graduated strip is placed a microscope with its axis horizontal. In the substage is placed a 2″ objective, producing an image of the graduations at the focus of the object-glass of the instrument. At the common focus of the two lenses is placed the tuning-fork, the stem of which is held vertical in a vice. The fork is partially inclosed in a glass case, and is so adjusted that the image of one of its limbs seems to cut the image of the graduations at right angles. The fork is set in motion by a suspended double-bass bow. If, when the fork is in vibration the drum is made to rotate with such a velocity that one of the graduations passes over the interval between two adjacent graduations in the time of one vibration of the fork, a stationary wave is seen of length equal to the length of that interval. To determine the number of vibrations of the fork in a given time, it is only necessary, therefore, to be able to count the number of graduations which pass in that period. As a perfectly uniform rotation has not been obtained, a regulator under the control of the operator is employed. This consists merely of a piece of string which passes round the axis of the drum, and also round a pulley which can be turned by the operator's left hand. An upward or downward motion of the wave denotes that the drum is going too fast or too slow, and by means of the pulley a gentle check or acceleration sufficient to keep the wave steady is given to the drum.

An electric counter gives the number of complete revolutions accomplished by the drum in any given period, and a fine-pointed tube, containing magenta, is carried by a saddle above the drum, and being actuated by an electro-magnet, makes a dot on a piece of white paper wrapped round the drum at the beginning and end of the experiment. The distance apart of these dots gives the additional fraction of a revolution accomplished by the drum during the period of the experiment. Electric circuits are so arranged that a reverser turned a few seconds before the minute at which it is intended to begin the experiment, causes a current to be sent exactly at that minute by the clock relay, which starts the electric counter, and also makes a dot on the drum. Just before the expiration of the last minute of the experiment the reverser is turned in the opposite direction, and at the expiration of that minute the counter is stopped, and a second mark made on the drum.

Some of the results obtained with different forks are given.

The results of further experiments made to determine the effect of temperature, of continuous and intermittent bowing, and of the mode of fixing the fork are appended.

An optical method by which two slightly dissonant forks may be compared without altering the period of either, is described.

Figures and diagrams fully explaining the apparatus employed accompany the paper.

February 13.—"Note on the Development of the Olfactory Nerve and Olfactory Organ of Vertebrates." By A. Milnes Marshall, M.A., D.Sc., Fellow of St. John's College, Cambridge. Communicated by W. S. Savory, F.R.S., Surgeon to, and Lecturer on Surgery at, St. Bartholomew's Hospital.

In the course of an investigation into the development of the cranial nerves of the chick, certain facts came to light indicating that the olfactory nerve, instead of being, as usually described, a structure differing totally in its mode of origin from all the other nerves in the body, in reality "exactly corresponds in mode of development with the other cranial nerves, and with the posterior roots of the spinal nerves."[1]

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[1] *Proc.* Roy. Soc, March 8, 1877, p. 50, and *Quarterly Journal of Microscopical Science*, January, 1878, pp. 17-23.

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